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FLOOD INSURANCE STUDY

ORIGINAL

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CITY OF LAVACA, ARKANSAS
SEBASTIAN COUNTY

SEPTEMBER 29, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 050201

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Cox Creek Panel 01P

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

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FLOOD INSURANCE STUDY
CITY OF LAVACA, ARKANSAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the City of Lavaca, Sebastian County, Arkansas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

This Flood Insurance Study was prepared by compiling pertinent information for the flood hazard areas in the City of Lavaca from existing technical and/or scientific data originally prepared by others for purposes other than the preparation of this Flood Insurance Study. This existing data was reviewed by the Federal Emergency Management Agency (FEMA) prior to its use in the development of this Flood Insurance Study to ensure compliance with National Flood Insurance Program (NFIP) accuracy requirements.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses in this study represent a revision of the original analyses prepared by Garver & Garver, Inc., for FEMA, under Contract EMW-C-0063. The original work was completed in September 1980. The revised hydrologic and hydraulic analyses were prepared by the Arkansas State Highway and Transportation Department. The revised work was completed in January 1985.

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1.3 Coordination

On September 12, 1985, the results of this study were reviewed at a final Consultation and Coordination Officer's (CCO) meeting attended by representatives of FEMA, the City of Lavaca, and the Arkansas State Highway and Transportation Department.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Lavaca, Sebastian County, Arkansas. The area of study is shown on the Vicinity Map (Figure 1).

Cox Creek was studied by detailed methods from the downstream corporate limits to North Davis Street. In the revised study, modifications to the bridge opening over Cox Creek were taken into consideration. Discharges were lowered based on a revised hydrograph analysis. The areas studied by detailed methods were selected based upon the extent and validity of available existing hydrologic and hydraulic data.

2.2 Community Description

The City of Lavaca is located in the north-central portion of Sebastian County in western Arkansas, approximately 2 miles south of the Arkansas River and 8 miles east of Fort Smith. It is completely surrounded by unincorporated areas of Sebastian County. Lavaca is served by State Routes 96, 253, and 255 and the Missouri Pacific Railroad.

The population of Lavaca was relatively constant through 1960, but it has since shown steady growth. The population in 1978 was 873, an increase of 341 over the 1970 population (References 1 and 2).

Most of the industry is located in northern Sebastian County near Fort Smith. The close proximity of Lavaca to Fort Smith provides opportunities in both industry and commerce. However, agriculture still contributes to the economy of the area.

The study area has deep loamy soils in level to gently sloping terrain. The soils have a slow permeability which tends to limit infiltration of rainfall (Reference 3).

The average annual precipitation in the area is approximately 46 inches with temperature extremes ranging from 0 degrees Fahrenheit (°F) in the winter to 100°F in the summer (Reference 4).

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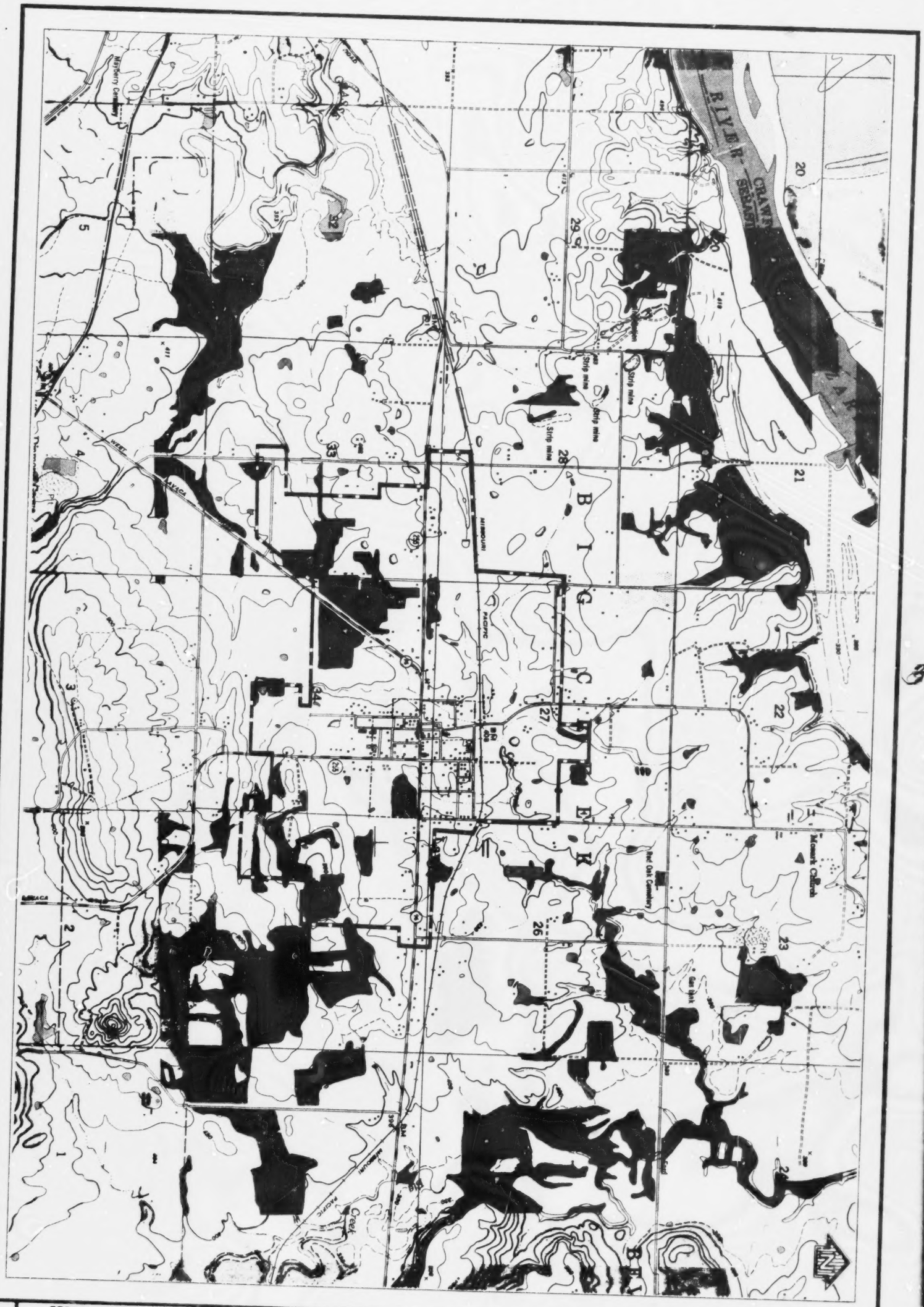

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LAVACA, AR

(SEBASTIAN CO.)

APPROXIMATE SCALE

2000 0 2000 4000 feet

VICINITY MAP

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Lavaca is situated in gently rolling terrain with elevations ranging from 390 to 450 feet. Most residential and commercial development in the city is located on higher terrain around Cox Creek. In recent years, there has been increased pressure for residential development in the flood plains along Cox Creek.

2.3 Principal Flood Problems

Flooding occurs very quickly but tends to be of short duration. The drainage basin of Cox Creek is limited to a small area around the community so that the heaviest runoff occurs from local rainfall. The chances of flooding are greatest in the spring and early summer when rainfall activity is more frequent, but flooding can occur at any time of the year.

2.4 Flood Protection Measures

No flood control projects or flood protection measures were found in the study area. Dams located in the Cox Creek watershed are for recreational purposes and do not aid in flood control.

3.0 ENGINEERING METHODS

For the flooding source studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

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3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for the flooding source studied in detail affecting the community.

Synthetic storms were computed to define the discharge-frequency relationships for Cox Creek. Rainfall distribution for the 10-, 50-, and 100-year floods were computed from rainfall-frequency data contained in Technical Paper No. 40 (Reference 5). Snyder's coefficients were used to compute hydrographs. These coefficients were then adjusted based on frequency-discharge data developed by the Little Rock District of the U. S. Army Corps of Engineers (COE) for streams in the study area. The hydrographs and rainfall distributions were used to compute synthetic storms of the desired frequencies from which the peak discharges were obtained. A log-probability relationship of the lower frequency peak discharges was used to compute each of the 500-year peak discharges.

A summary of drainage area-peak discharge relationships for Cox Creek is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
COX CREEK					
At County Road	3.21	1,690	2,240	2,490	2,900
At State Route 253	2.42	1,600	2,120	2,350	2,700
At North Davis Street	1.59	1,350	1,780	1,970	2,300

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the source studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Below-water sections of channels, bridges, and culverts were obtained by field surveys. Overbank portions of the cross sections were obtained from an aerial photogrammetric survey. Additional information was obtained from topographic maps of the study area (Reference 6).

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Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Water-surface elevations of floods of the selected recurrence intervals were computed using the COE HEC-2 step-backwater computer program (Reference 7). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations for Cox Creek were taken from a rating curve which was computed for the channel at the lower limit of the study. Final starting elevations were computed using the slope/area method.

Roughness coefficients (Manning's "n") used in the hydraulic computations were estimated by field inspection. The channel "n" values for Cox Creek ranged from 0.035 to 0.050, and the overbank "n" values ranged from 0.090 to 0.100.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For the stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps (Reference 6).

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The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodway in this study is presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodway presented in this study was computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for the stream segment for which a floodway is computed (Table 2).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Cox Creek								
A	145	240	1,053	2.2	402.6	402.6	402.8	0.2
B	2,360	350	904	2.2	405.2	405.2	405.8	0.6

[1]Feet above corporate limits

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LAVACA, AR

(SEBASTIAN CO.)

FLOODWAY DATA

COX CREEK

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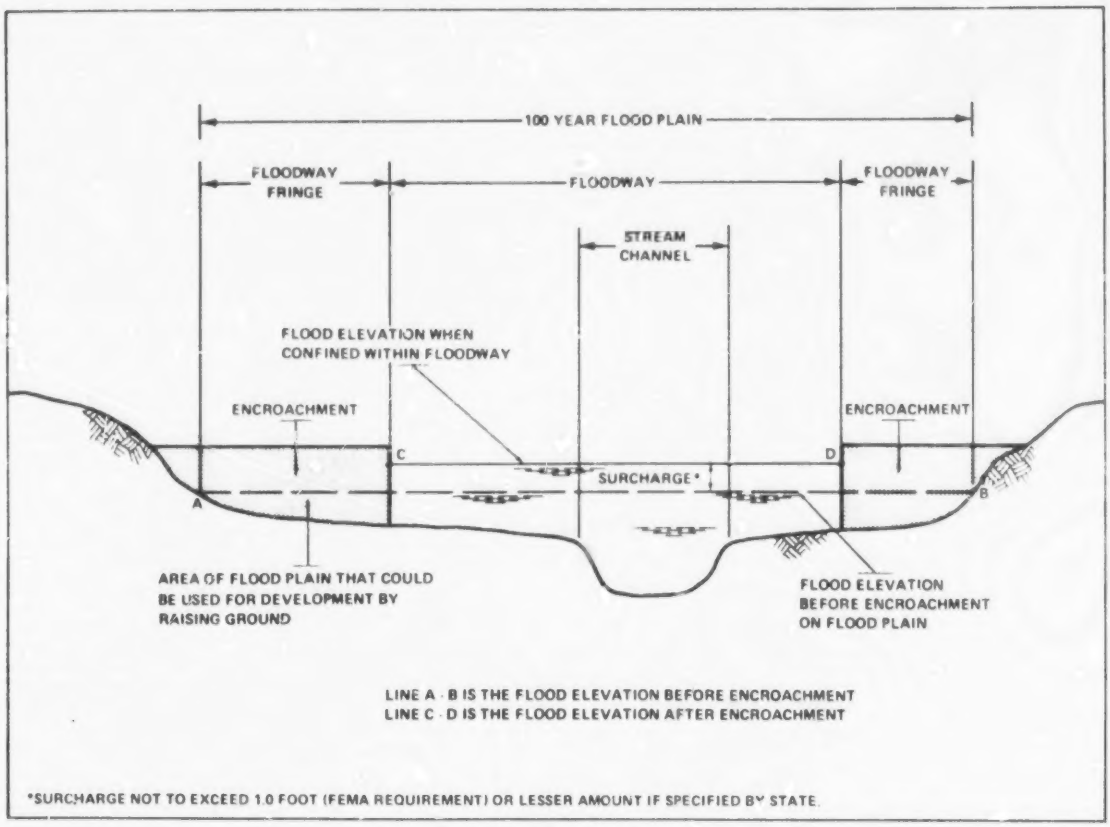
100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for the flooding source studied in detail in the City of Lavaca.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following tabulation for more than 20 percent of the reach:

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Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The location of the reach determined for the flooding source of the City of Lavaca is shown on the Flood Profiles (Exhibit 1) and summarized in Table 3.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A2: Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.

Zone B: Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Cox Creek Reach 1	05	-0.8	-0.2	+0.1	010	A2	Varies

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see map

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LAVACA, AR
(SEBASTIAN CO.)

FLOOD INSURANCE ZONE DATA

COX CREEK

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Zone C: Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding source studied in detail in the community are shown in Table 3.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Lavaca is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

This Flood Insurance Study was prepared by compiling existing hydrologic and hydraulic technical and scientific data prepared by the SCS and other organizations originally for purposes other than the preparation of this Flood Insurance Study. The data was identified as the best available at the time of compilation of this Flood Insurance Study and should depict the general conditions of the flooding sources with relative accuracy. FEMA performed a cursory review and accepted the data as valid for purposes of this Flood Insurance Study and the NFIP. However, if better information is known to exist or has been developed since the date of this report, the information should be immediately forwarded to the Natural and Technological Hazards Division, Federal Emergency Management Agency (Regional Director, Region VI Office, Federal Center, Denton, Texas 76201) for consideration for revision of this study.

A Flood Insurance Study has previously been published for the City of Lavaca (Reference 8). The differences between that study and this study are justified due to the more detailed nature of this Flood Insurance Study.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Regional Director, Region VI Office, Federal Center, Denton, Texas 76201.

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8.0 BIBLIOGRAPHY AND REFERENCES

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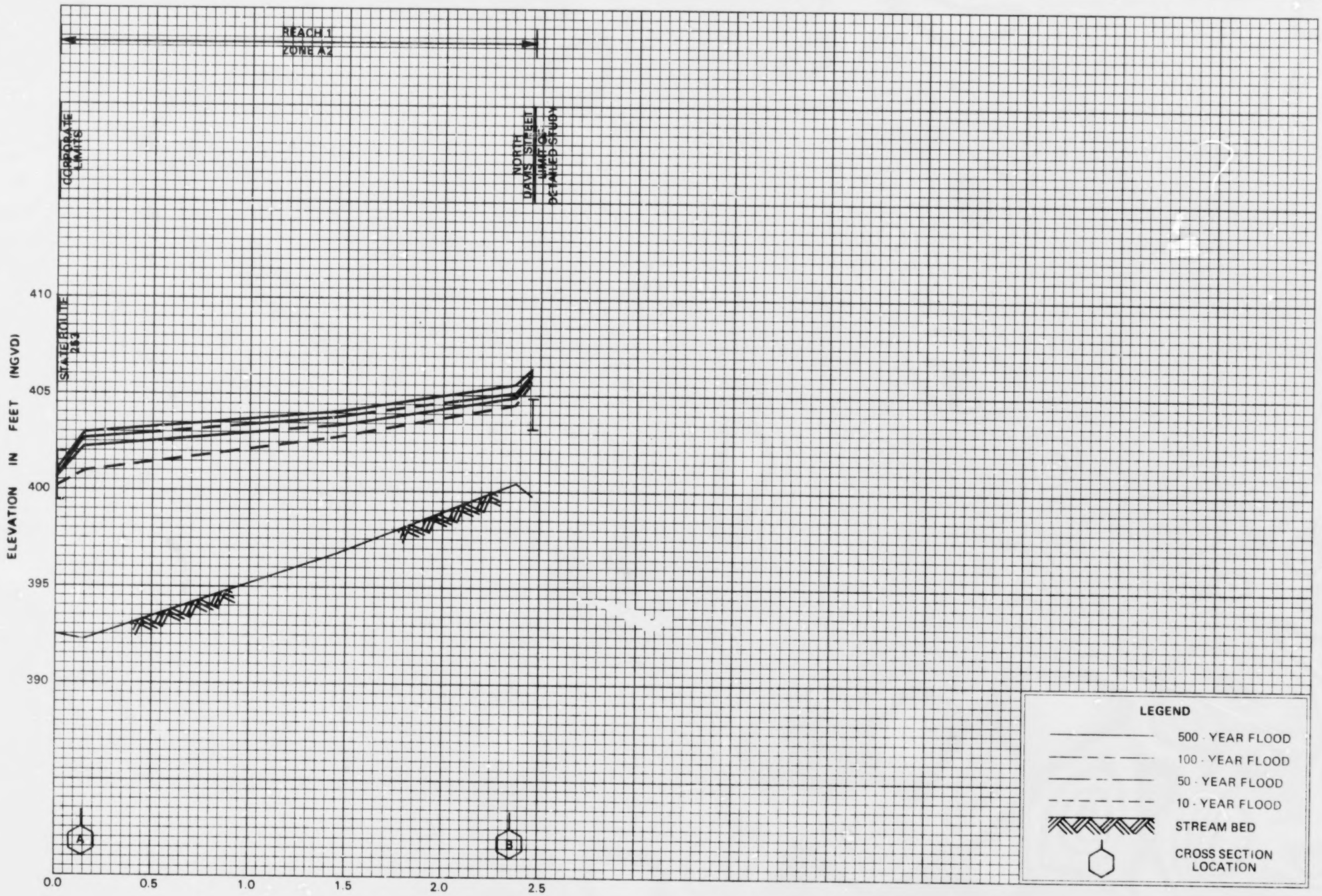

FLOOD PROFILES

COX CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF LAVACA, AR

(SEBASTIAN CO.)

01P

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